

CYTOLOGICAL STUDIES IN THE GENUS FICUS. III.
CHROMOSOME NUMBERS IN SIXTY-TWO SPECIES

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Ficus is a genus the woody plants of which are widely distributed in tropical and subtropical countries. It is a fantastic as well as a confusing member of the plant kingdom. It is fantastic because of the extreme diversity of plant forms exhibited, i.e., size, habit of growth, leaves, flower characters, and also by reason of the symbiotic relationship of certain insects which inhabit the receptacles. It is a confusing group because of the many perplexing problems in nomenclature and because of the difficulties encountered in identification of specimens either collected in their native habitat or found growing under cultivation. Interest in the genus has resulted in the description of many species, variously estimated from 600 to 1500. In *Index Kewensis*, 1887 specific names are listed for *Ficus*.

Cytologically, however, this large genus is not well known (Condit, 1928; 1933; Krause, 1930; 1931; Mangenot and Mangenot, 1958; Sugiura, 1936). It is believed that the species reported earlier (Condit, 1928; 1933) were accurately determined with the following exceptions: *F. glomerata* Roxb. should be *F. racemosa* L.; *F. indica* L. growing in the Lyon Arboretum, Honolulu, is regarded as a distinct species and not conspecific with *F. bengalensis* L.; the authenticity of plants grown in California under the name *F. asperrima* Rozb. is questionable and should be called *F. gibbosa* Blume; and *F. nigens*? should be *F. ingens* Miq. The somatic chromosome number was found to be 26 in 37 species. In seven species the gametic number was 13. In some instances the somatic number was reported to be 24, 25, 27, or 28 and the gametic number 14. Neither the species, nor the unisexual plants with long-styled pistillate flowers or the bisexual caprifigs with short-styled pistillate and staminate flowers, seem to be distinguished by peculiarities in chromosome morphology.

This paper presents chromosome numbers of 62 species of *Ficus* plus counts of a few species unidentified or previously reported under other specific names (table 1). Nomenclature is based mainly on the recent papers of Corner (1960; 1961; 1961a) and DeWolf (1960).

Root tips from potted plants grown mostly in a greenhouse at the Citrus Research Center, University of California, Riverside (CRC), furnish most of the material for study. Plant introduction numbers (PI) of the United States Department of Agriculture and of the Hawaiian Sugar Planters' Association (HSPA) are given when applicable. Root tips were fixed in Karpechenko's solution, embedded in paraffin, sectioned and stained in Haidenhain's iron-haematoxylin, as reported in the earlier papers.

Practically all cultivated species of *Ficus* have been introduced without the specific insect which normally inhabits the receptacles. I have made no studies nor have I found any report as to the extent to which the

TABLE 1. CHROMOSOME COUNTS IN FICUS

Diploid group, $2n=26$

Ficus acanthocarpa Lev. & Van., HSPA 1686, China. *F. afzelii* G. Don, from Missouri Botanical Garden, a Belgian Congo species. *F. amplissiam* Smith, PI 93398, Poona, India as *F. tsiela* Roxb. *F. aurantiaca* Grif. var. *parvifolia* Corn., PI 134991, Philippines. *F. aurea* Nutt., CRC, Florida. *F. auriculata* Lour., PI 77952, India. *F. avi-avi* Bojer, CRC, Madagascar. *F. awekeotsang* Makino (*F. pumila* L.), CRC, Taiwan. *F. bussei* Mildbr. & Burr., PI 62806, Tanganyika, Africa. *F. cabusana* Standl. & Steyerl., CRC, from a California nursery, identified at *F. F. camarinensis* Merr., HSPA 1819, 1829, 1849, Luzon, Philippines. *F. capensis* Thunb., PI 73935, Gambia, Africa. *F. citrifolia* Mill., CRC, Paraguay, as *F. eximia* Schott var. *glabra* Hassl. *F. cocculifolia* Baker var. *sakalavarum* (Baker) H. Perr., CRC, Madagascar. *F. columnaris* Muell. & Moore (*F. macrophylla* Desf.), PI 141765, Sydney, Australia. *F. costaricana* Miq., PI 262188, El Salvador. *F. congesta* Roxb., HSPA 1545, 1775, Philippines, as *F. salterthwaitii* Elmer. *F. coronata* Spin., CRC, Queensland, Australia, as *F. scabra* Forst. *F. cotinifolia* H. B. K., PI 159445, Alamos, Mexico. *F. doliararia* Mart., CRC, Campinas, Brazil. *F. geniculata* Kurz., CRC, Buitenzorg, Java. *F. gnaphalocarpa* Miq., CRC, Senegal, West Africa. *F. goldmanii* Standl., CRC, Alamos, Mexico. *F. hillii* Bailey (*F. retusa* L. var. *nitida* Thunb.), Australia. *F. hispida* L., PI 80081, Darjeeling, India. *F. insipida* Willd., PI 74426, Summit, Canal Zone. *F. iteophylla* Miq., PI 137932, Nigeria, Africa. *F. lapathifolia* Miq., CRC, Chiapas, Mexico. *F. krishnae* C. DC., PI 123211, a bud sport of *F. bengalensis* L. *F. mallotocarpa* Warb., HSPA 5639, Nairobi, Africa. *F. mammilifera* Warb., CRC, Jamaica. *F. minahassae* Miq., CRC, Laguna, Philippines. *F. monckii* Hassl., CRC, Buenos Aires, Argentina. *F. montana* Burm., PI 101330, a Malaysian species common in nurseries. *F. nekbudu* Warb., Los Angeles State and County Arboretum, Arcadia, an east African species common in cultivation. *F. nota* Merr., PI 134993, Philippines. *F. nymphaeifolia* Mill., PI 161328, Caracas, Venezuela. *F. obtusifolia* H. B. K., PI 161324, Mazatlan, Mexico. *F. perforata* L., CRC, Jamaica, as *F. wilsonii* Warb. *F. pertusa* L., PI 92350, Chiapas, Mexico. *F. petiolaris* H. B. K., PI 161331, Alamos, Mexico. *F. pilosa* Blume, CRC, Bogor, Indonesia. *F. preusii* Warb., PI 262356, Netherlands, native in the Kamerun, Africa. *F. procera* Reinw. var. *crassiramea* King, PI 94297, Buitenzorg, Java. *F. radulina* Wats., PI 159446, Alamos, Mexico. *F. ribes* Blume, HSPA 1464, Philippines; HSPA 3275, Java. *F. rigo* Bailey, PI 94210, British New Guinea. *F. rumphii* Blume, CRC, Allahabad, India. *F. soldanella* Warb., CRC, Pretoria, South Africa. *F. stricta* Miq., PI 268135, Laguna, Philippines. *F. subcordata* Blume, CRC, Buitenzorg, Java, as *F. garciniaefolia* Miq. *F. thonningii* Blume., CRC, Nairobi, East Africa. *F. tinctoria* Forst., PI 78577, Guam. *F. umbellata* Vahl., PI 75751, Gold Coast, Africa. *F. urbaniana* Warb., PI 161335, Caracas, Venezuela. *F. urceolaris* Hiern., PI 76424, Uganda, Africa. *F. variegata* Blume, PI 122987, Botanic Gardens, Straits Settlements. *F. volkensii* Warb., PI 78261, Tanganyika, Africa. *F. wildemaniana* Wildem. & Th. Dur., an African species introduced by a Florida nursery from Denmark. *F. sp.*, PI 97571, Grenadine Islands; PI 101329, France; PI 103504, India; PI 95089, Singapore.

Tetraploid group, $2n=52$

Ficus burkei Miq., CRC, Pretoria, South Africa. *F. hochstetteri* A. Rich., CRC, Nairobi, East Africa. *F. pretoriae* Burt-Davy, PI 137595, Pretoria, South Africa. *F. sonderi* Miq., CRC, Pretoria, South Africa. *F. stuhlmanii* Warb., PI 161334, Pretoria, South Africa.

Miscellaneous Group

Ficus elastica Roxb. 'Decora,' $2n=39$, a common horticultural variety. *F. dusenii* Warb., $2n=26, 52$, France, native of tropical Africa. *F. macrosyce* Pitt. (*F. insipida* Willd.), $2n=26, 52$, CRC, Caracas, Venezuela. *F. palmeri* Wats., $2n=26, 50?$, CRC, La Paz, Baja California, Mexico.

staminate flowers of cultivated species develop before the fruit shrivels and drops.

Of the new counts reported, 53 are diploid with a somatic chromosome number of 26. One triploid is reported, *F. elastica* 'Decora,' in which $2n=39$. This cultivar of the common india rubber is apparently from a seedling selected in Belgium over 30 years ago on account of its broad leaves and bright coloration. Since no other similar variety of *F. elastica* has been reported with diploid chromosome groups, there is a possibility that the triploid 'Decora' is a hybrid.

Five species are tetraploid with $2n=52$. Four of these, *F. burkei*, *F. pretoriae*, *F. sonderi*, and *F. stuhlmanii*, are indigenous to South Africa, while *F. hochstetteri* is native in East Africa. The last is closely related to *F. thonningii* which is diploid (table 1). Further cytological studies of these two species are warranted. Plants of these five species show no superficial characters suggesting a condition of tetraploidy when under cultivation in southern California.

In three species some prepared materials show chromosome counts to be 26, others 52. *Ficus dusenii*, for example, a species of tropical Africa, was represented in our collection by four potted plants. Chromosome counts of root-tip material from these plants were conflicting. In one plant, both complements, 26 and 52 were counted. In the other three the prevailing number was 52. The occurrence of islands of tetraploid cells in root-tips of diploids has been reported in tomato (Lesley, 1925). Possibly some species are periclinal chimeras of diploid and tetraploid tissues. *Ficus palmeri* is represented in our collection by four separate slide preparations. Two showed diploid complements and two both diploid and tetraploid on the same slide. In *F. macrosyce* one slide showed a diploid complement, another showed both diploid and tetraploid complements.

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